CLAIMS

What is claimed is:

1. A nozzle for an injection molding machine, comprising:

a nozzle body having first and second passageways therethrough;

an inner nozzle having a first end and having an orifice at a second end, said inner nozzle having a passageway therethrough in fluid communication with said nozzle body first passageway; and

an outer nozzle removably and fixedly coupled to said nozzle body at a first end and having an orifice at a second end, said outer nozzle having a passageway therethrough in fluid communication with said nozzle body second passageway, said inner nozzle being positioned within said outer nozzle passageway.

2. The nozzle of claim 1, wherein said nozzle body further includes:

a counter bore defining an inner wall and a ledge, a portion of said inner wall being threaded; and

an annular groove in said counter bore ledge, said annular groove being in fluid communication with said nozzle body second passageway.

3. The nozzle of claim 2, wherein said annular groove has a hemispherical shape.

4. The nozzle of claim 2, wherein said outer nozzle further includes:

a wall having a threaded portion to matingly engage said nozzle body inner wall threaded portion; and

an annular groove on an inner end of said outer nozzle wall positioned to matingly engage said nozzle body annular groove to provide fluid communication between said nozzle body second passageway and an inner surface of said outer nozzle wall.

5. The nozzle of claim 4, wherein said outer nozzle annular groove has a hemispherical shape.

6. The nozzle of claim 4, wherein:

said outer nozzle further includes a ledge in said inner surface of said outer nozzle wall; and

said inner nozzle further includes a wall having a ledge on an outer surface of said inner nozzle wall, said inner nozzle ledge configured to matingly engage said outer nozzle ledge.

7. The nozzle of claim 6, wherein said inner and outer nozzles are configured such that when said inner nozzle ledge is matingly engaged with said outer nozzle ledge and said outer wall threaded portion is matingly engaged with said nozzle body inner wall threaded portion, said inner nozzle is retained such that said inner nozzle passageway is in fluid communication with said nozzle body first passageway and said outer nozzle passageway is in fluid communication with said nozzle body second passageway.

8. The nozzle of claim 7, wherein said nozzle body, said inner nozzle, and said outer nozzle are all substantially concentric.

9. The nozzle of claim 1, wherein:

said inner nozzle orifice and said outer nozzle orifice are substantially concentric and substantially coplanar; and

said outer nozzle orifice substantially surrounds said inner nozzle orifice.

10. The nozzle of claim 9, wherein said inner nozzle orifice has a diameter of approximately 0.020 inch to approximately 0.150 inch.

11. The nozzle of claim 10, wherein said outer nozzle orifice has a diameter of approximately 0.050 inch to approximately 0.250 inch.

12. The nozzle of claim 1, wherein a ratio of a diameter of said outer nozzle to a diameter of said inner nozzle is from approximately 1:1 to approximately 10:1.

13. The nozzle of claim 12, wherein said ratio is less than approximately 5:1.

14. The nozzle of claim 12, wherein said ratio is less than approximately 3:1.

15. The nozzle of claim 1, wherein:

said inner nozzle orifice and said outer nozzle orifice are substantially concentric and not substantially coplanar; and

said outer nozzle orifice substantially surrounds said inner nozzle orifice.

16. The nozzle of claim 1, wherein:

said inner nozzle further includes a wall having an inner surface and an outer surface;

said inner surface defines said inner nozzle passageway; and

said outer surface has a plurality of radial grooves, said radial grooves being in fluid communication with said nozzle body second passageway.

17. The nozzle of claim 16, wherein:

said radial grooves extend from said inner nozzle first end to an alignment diameter of said inner nozzle;

said inner nozzle further includes an annular groove between said alignment diameter and said inner nozzle orifice; and

said inner nozzle further includes a plurality of outer passageways providing fluid communication between said radial grooves and said inner nozzle annular groove.

18. The nozzle of claim 17, wherein:

said inner nozzle further includes a tapered section between said inner nozzle annular groove and said inner nozzle second end; and

an end of said tapered section and said outer nozzle defines said outer nozzle orifice, said outer nozzle orifice being annular.

19. The nozzle of claim 18, wherein said inner nozzle further includes a section having a substantially uniform diameter between said inner nozzle annular groove and said tapered section.

20. A method, comprising:

a) providing a nozzle including:

i) a nozzle body having first and second passageways therethrough;

ii) an inner nozzle having a first end and having an orifice at a second end, said inner nozzle having a passageway therethrough in fluid communication with said nozzle body first passageway; and

iii) an outer nozzle removably and fixedly coupled to said nozzle body at a first end and having an orifice at a second end, said outer nozzle having a passageway therethrough in fluid communication with said nozzle body second passageway, said inner nozzle being positioned within said outer nozzle passageway;

b) providing a first material to said nozzle body first passageway;

c) providing a second material to said nozzle body second passageway;

d) discharging said first material from said inner nozzle orifice; and

e) discharging said second material from said outer nozzle orifice.

21. The method of claim 20, wherein steps d) and e) occur simultaneously, at least in part.

22. The method of claim 20, wherein step d) concludes prior to step e).

23. The method of claim 20, further comprising f) minimizing waste.

24. The method of claim 20, wherein step d) includes:

flowing said first material through said nozzle body first passageway;

flowing said first material through said inner nozzle passageway; and

flowing said first material through said inner nozzle orifice.

25. The method of claim 20, wherein step a) includes providing said nozzle with said inner nozzle, wherein:

said inner nozzle further includes a wall having an inner surface and an outer surface;

said inner surface defines said inner nozzle passageway; and

said outer surface has a plurality of radial grooves, said radial grooves being in fluid communication with said nozzle body second passageway.

26. The method of claim 25, wherein step a) further includes providing said nozzle with said inner nozzle, wherein:

said radial grooves extend from said inner nozzle first end to an alignment diameter of said inner nozzle;

said inner nozzle further includes an annular groove between said alignment diameter and said inner nozzle orifice; and

said inner nozzle further includes a plurality of outer passageways providing fluid communication between said radial grooves and said inner nozzle annular groove.